U. S. DEPARTMENT OF COMMERCE

# Technical News Bulletin

of the

## National Bureau of Standards

★ *Issued Monthly* ★

Washington AUGUST 1938[1] Number 256

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### EYE-PROTECTIVE GLASSES

Circular C421, which has just been released, deals with a subject of first importance to everyone—the conservation of eyesight. Eye protection has received much attention from scientists and engineers, because, while the natural protective mechanism of the eye is sufficient to guard against ordinary intensities of illumination, it is inadequate to care for the excessive glare encountered by participants in snow sports, those who take long automobile trips, and men engaged in such industrial occupations as furnace work, gas and electric welding, firing of boilers, etc. For protection against these abnormal light conditions, spectacle glasses of various colors are used.

At intervals during the past 20 years, W. W. Coblentz, chief of the Bureau's radiometry section, has published results of researches on the spectral transmissive properties of various types of colored glasses, designed to protect the eyes from injurious amounts of ultraviolet and infra-red radiation. Since reprints of these papers are no longer available, Circular C421 has been issued to supply the continued demand for information on the transmissive properties of different makes of tinted lenses for outdoor wear, and on deeply colored lenses made especially to protect the eyes of industrial workers, including lenses known by the following trade names: Amethyst, Avitint, Azurlite, Bluelite, Calobar, Cerulite, Cruxite, Diantholite, Kalichrome, Noviol, Noviweld, Polaroid, Roselite, Softlite, Solarex, Viopake, etc. For convenience in exposition of the data, the various tinted lenses are grouped under the color that predominates in transmission—amber, green, blue. An introductory section discusses such important incidental questions as: Elimination of glare; distortion of colors; confusion of traffic signals; the hazard in wearing colored glasses when driving at night; and the importance of having standard shades, etc.

Copies of Circular C421 are obtainable from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 10 cents each.

### SPECIFICATIONS FOR A PRECISION-MAPPING CAMERA

The requirements of the government agencies interested in crop control, soil conservation, large-scale irrigation proj-

[1] Published with approval of the Director of the Budget.

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ects, and the installation of hydroelectric plants have greatly accelerated the photographing of large areas of the United States from the air. It is desirable that these photographs be of such quality and character that they may be satisfactory, not only for present needs, but also for other purposes that may develop, and thus save the expense of reflying territory that has once been photographed. To insure the production of such photographs it is necessary that the airplane camera be of suitable accuracy and correctly calibrated. The American Society of Photogrammetry has recognized this need and has appointed a committee on precision cameras to formulate camera specifications. An article by Irvine C. Gardner, entitled "Specifications for a Precision-Mapping Camera," which will be published in "Photogrammetric Engineering," presents the results of an investigation made in connection with the work of this committee.

## NATIONAL ELECTRICAL SAFETY CODE

A meeting of the sectional committee for revision of the National Electrical Safety Code was held at the Bureau on June 20. In preparation for this meeting, reports of technical committees were circulated and reviewed. The meeting took action for the final revision of part 4 of the code, and adopted a large number of items in the revision of part 2 which had been prepared by the technical committee and subcommittees. The revised text of part 4 has been prepared for printing and will appear as a new Handbook (H34) dealing with that part of the code.

## DIRECT-CURRENT ELECTROLYTIC RESISTORS FOR MEASURING TEMPERATURES

An improved electrolytic resistor, developed primarily for temperature indicators on radio meteorographs, is described in a paper (RP1126) by D. Norman Craig to be published in the Journal of Research for August. Many types and kinds of electrolytic resistors have been made, but most of these are subject to limitations of polarization, gassing, or lack of permanence when used in direct current circuits. They are, therefore, more commonly used with alternating currents. However, certain types may be used successfully for temperature indicators on radio meteorographs where variable direct currents must be employed.

Electrolytic resistors to be suitable for this purpose must have a large temperature coefficient of resistance, a freezing point below any probable atmospheric temperature, light weight, reversibility of electrochemical reactions, stability to retain their initial calibration, hermetical sealing, high resistance with a minimum of inductance and capacity, and rapid response to temperature changes.

Although a number of electrolytes might be chosen which would fulfill satisfactorily the requirements of resistance and temperature coefficient, the other requirements limit the choice of materials. The solutions chosen contained varying amounts of hydrochloric acid, ethyl alcohol, and cuprous chloride. The alcohol in sufficient amount depresses the freezing point below —75° C., and by varying the proportions it affords a ready means for adjusting the resistance of the cell to a desired value. The hydrochloric acid is the principal conducting medium, and the cuprous chloride provides reversibility. These constituents are not a haphazard choice, because it is necessary that the copper salt should remain in solution at the lowest temperatures.

The cell consisted of a U-shaped capillary tube containing the solution and copper electrodes. The upper extremities were sealed. It was calibrated by making resistance measurements at various temperatures and calculating resistance ratios based on some fixed reference temperature. Numerous tests showed that the cells retained their initial calibration, and when impressed voltages were one volt or slightly more, the temperature indications, even at low temperatures, were dependable within 1° C.

These resistors possess properties which should make them useful in other applications on either a.-c. or d.-c. circuits.

## SODIUM NITRATE CRYSTALS

The work on a method of growing large clear crystals of sodium nitrate described in Technical News Bulletin 252 (April 1938), has been continued. During the month several melts have been made, varying the details to find which procedure gives the best results. It becomes more and more apparent that purity of the starting material is of the utmost importance. Slow crystallization from the melt appears to be an excellent method of purification; most of the

impurities remain in the last third or fourth of the melt, and may be poured off while still melted. It is surprising how much impurity is found to be present, even in reagent-quality material.

## ACCELERATED AGING OF LEATHER IN THE OXYGEN BOMB

For the last two years Joseph Kanagy of the Bureau's leather section has been investigating the behavior of leather in an oxygen bomb, the data to be used in working out an accelerated-aging test. Such a test is important in the development of leathers where long service is required as, for example, bookbinding and upholstery leathers. It would also be a valuable addition to existing test methods and would save time in research.

The results of a previous investigation, referred to in Technical News Bulletin 254 (June 1938), indicated that when samples of chestnut- or quebracho-tanned leather were dried in an oven at 100° C. for 24 hours and then exposed in the bomb to an atmosphere of oxygen initially at 100 lb./in.$^2$ and aged at 100° C. for 7 days, the results compared favorably with those obtained when similar leathers were aged under normal conditions for 10 years. The present investigation is a continuation of this study. Various tannages of leather and raw hide were exposed in the oxygen bomb under the same conditions as before. The amounts of carbon dioxide and water evolved from some of the leathers and raw hide, when heated in a stream of 100° C., were also determined, and these results for the vegetable-tanned leathers were related to their stabilities in the oxygen bomb.

The results, which will be published in full in the August Journal of Research (RP1128), indicate that such factors as stability of the tannins to oxidation, tanning properties of the tanning materials, and conditions which weaken the hide substance during the tanning process, are reflected in the results obtained in the bomb. Moreover, the mechanism of the deterioration also appears to be similar to that occurring under normal aging conditions. For these reasons, it is concluded that aging under the accelerated conditions in the oxygen bomb should give valuable indications as to the normal aging properties of a leather.

## CARBOHYDRATE CONSTITUENTS OF ENZYMES

The work of the Bureau's polarimetry section has received signal recognition by the award of a Lalor Fellowship to W. W. Pigman. Dr. Pigman left the Bureau on July 15 to work with Dr. B. Helferich at the University of Leipzig, Germany, on the carbohydrate constituents of enzymes.

## SEPARATION OF ISOPROPYLBENZENE FROM PETROLEUM

In separating the aromatic constituents of the fraction of an Oklahoma petroleum distilling between 144° and 154° C. (part of the API research project at the Bureau), Joseph D. White and Frank W. Rose, Jr., have succeeded in isolating isopropylbenzene.

In addition to the expressed purpose of isolating the individual components of the gasoline, an important object of the present work was to free the paraffinic and naphthenic hydrocarbons, which were the major components of the fraction, from the aromatic constituents which were present in low concentrations—about 3 percent. This was effectively accomplished by absorbing the latter with silica gel. The aromatic components comprised about 30 mole percent of the absorbed material, from which they were separated, almost quantitatively, by azeotropic distillation with glacial acetic acid. This method was proved to be effective by first separating a synthetic mixture of isopropylbenzene and *n*-nonane.

As explained in RP1122 in the August Journal of Research, by fractional distillation of the aromatic concentrate in an efficient still, a sample of isopropylbenzene was obtained which had a purity of 98.4 mole percent. Its identity was established by the excellent agreement of its physical properties with those of a synthetic sample having a calculated purity of 99.8 mole percent. The constants for the synthetic sample were found to be: boiling point, 152.38° C.; freezing point, —96.25° C.; density at 20° C., 0.8633; refractive index at 20° C. and for the D-line of sodium, 1.4915.

Isopropylbenzene constitutes only about 0.03 percent of the petroleum under investigation. Distillation of the aromatic concentrate from which it was

obtained gave evidence, also, of the presence of *n*-propylbenzene. Further work on its separation is in progress.

Properties of the residual nonaromatic portion of the petroleum fraction boiling between 144° and 154° C. indicate that it is chiefly composed of naphthenic hydrocarbons.

## SEPARATION OF PETROLEUM HYDROCARBONS BY ACETIC ACID

The examination of the gasoline fraction of a crude petroleum may be simplified if, after distillation has produced cuts boiling over moderately narrow ranges, such fractions are then separated into several concentrates containing different classes of hydrocarbons. These concentrates can then be separately redistilled and treated in a manner appropriate to the individual constituents. To accomplish this, a method employing distillation with an azeotropic agent, acetic acid, has been developed by Frank W. Rose, Jr., and Joseph D. White as part of Research Project 6 of the American Petroleum Institute. This procedure is applicable to the portion of petroleum boiling between 130° to 175° C.

The behavior of a synthetic mixture of *n*-nonane and isopropylbenzene with acetic acid was studied in a 30-plate bubble-cap glass column. A roughly quantitative separation was obtained (exclusive of about 10 percent of intermediate materials).

The systematic distillation, with acetic acid, of the fraction of an Oklahoma petroleum boiling normally between 154° and 162° C. yielded a paraffin-naphthene mixture and an aromatic concentrate. Traces of aromatic hydrocarbons were removed from the paraffin-naphthene mixture by adsorption on silica gel. Redistillation of the aromatic concentrate with acetic acid removed all but the aromatic hydrocarbons. By proper recycling of the intermediate fractions, only about 1 percent of the entire fraction remained not allocated to the concentrates. Distillation of the paraffin-naphthene mixture as oil at 215 mm Hg showed paraffinic constituents boiling near 157° C, and naphthenic constituents near 161° C. On distillation of the aromatic concentrate, the major portion of the distillate had a boiling range of 158.5° to 164.5° C., about 5° higher than the material from which it came. Apparently this material contains *n*-propylbenzene and the methylethylbenzenes as well as higher-boiling trimethylbenzenes.

The complete report of this work will be published as RP1123 in the Journal of Research for August.

## ARC SPECTRUM OF SILICON

The element silicon, which is one of the constituents of ordinary sand, is widely distributed in the earth's crust. Its presence in the remote sun and stars is revealed by the various colored light rays that appear in its spectrum. Heretofore the only silicon lines available for astrophysical studies were the few blue and yellow lines that appear in the visible region of the spectrum. But from investigations made in recent years, in England, and also at the Bureau, it was found that an extensive array of silicon lines appears in the ultraviolet and in the infrared regions of the spectrum. A new survey of the entire spectrum accessible to modern photographic methods has been made by C. C. Kiess, with the result that many new lines have been added to the list. An account of this work will be published in the August number of the Journal of Research (RP1124). About 400 lines are now known and nearly all of these have been classified as combinations between the terms that represent the various energy states of neutral silicon atoms. The terms that have been found correspond strictly with those required theoretically. They form numerous series of three or more members each, and lead to a value of 8.11 volts for the ionization potential of silicon; that is, the amount of enegy required to detach one of its valence electrons from the atom. Nearly all the observed silicon lines longer than 3000 A, and many unobserved lines predictable from the terms, are found to correspond with unidentified Fraunhofer lines, thereby attesting the abundance of silicon in the sun also.

## ARC AND SPARK SPECTRA OF TUNGSTEN

About 13 years ago an attempt was made at the Bureau to work out the structure of the spectrum emitted by singly ionized tungsten atoms, but, largely because of the inadequate descriptions of the spectrum available at that time, the attempt was unsuccessful. Since then, this deficiency of observational data has been remedied, for, with the installation of the world's largest quartz prism spectrograph, it has been possible to obtain photographs of the ultraviolet portion of the spectrum. Measurements of these spectrograms by Donald D. Laun have supplied the data necessary to start to work out the term

structure of W II. The wave-length observations were supplemented by a series of Zeeman effect observations made with the same spectrograph. The manner in which a spectrum line splits up in a magnetic field has thus been determined, and this is an important clue to the terms that combine to produce the line. As a consequence of the new observational material, an analysis of the spectrum has led to the classification of about 500 lines of W II, representing the combinations of 27 low and metastable even terms with 50 off terms. The observations have also supplied an improved description of the ultraviolet portion of the arc spectrum, W I, and have led to the discovery of many new odd levels that combine with previously known even levels.

The complete report will be published as RP1125 in the August Journal of Research.

## DETERMINATION OF BORON IN STEEL AND CAST IRON

The increasing use of boron in the manufacture of metallurgical products, both as a scavenger and as an alloying constituent, has made desirable an accurate method for its determination when present in small amounts. A method for this determination is described in an article by John L. Hague and Harry A. Bright in the August number of the Journal of Research (RP1120). The procedure calls for: Solution of the sample in hydrochloric acid, followed by oxidation with hydrogen peroxide; distillation of methyl borate (Chapin's method); and titration of boric acid with sodium hydroxide in the presence of mannite. Selenium and tellurium do not interfere, but germanium, a very minor constituent rarely present in ferrous alloys, causes small positive errors. Directions are given for examing any acid-insoluble residue for boron. Data obtained by applying the method to a number of ferrous alloys show that results accurate to $\pm 0.002$ percent can be expected with irons and steels containing from 0.005 to 0.1 percent of boron.

## ELECTRIC FURNACE FOR DETERMINING PYROMETRIC CONE EQUIVALENTS

The quality of fire-clay products is frequently judged solely by their refractoriness or resistance to high temperature. The practice is to make the material into small tetrahedrons (1 in. long and ¼ in. at the base), and heat them until they become soft enough to deform under their own weight when standing upright. At different times in the past, such terms as "melting point," "softening point," or "fusion point" have been used rather loosely to express the temperature at which that deformation occurs. At the present time the term used to define this end point is "pyrometric cone equivalent."

Standard pyrometric cones are prepared from batch compositions of known softening temperatures. In determining the softening point of a refractory material, the end point is expressed in terms of the standard cone of equivalent refractoriness, hence the term "pyrometric cone equivalent."

Very high temperatures (up to 1,800° C. or approximately 3,300° F.) are sometimes required to make these determinations. Among the special types of furnaces for this purpose is the electrically heated carbon-resistance type used at the Bureau. A report has been prepared by William L. Pendergast for publication in the Journal of the American Ceramic Society, which describes in detail how this furnace may be constructed. It also points out the many changes which have been made and the equipment which has been added since the first report was published a number of years ago.

## HEAT OF SOLUTION OF LIME AND MAGNESIA

Ever since lime has been used as a building material it has been known that the reaction of the constituents of lime with water liberates a considerable quantity of heat. The heat evolved has been measured by various investigators, results being obtained by direct hydration or by the method of heat of solution. The heat evolved during hydration can be derived from the difference between the heat solution of the unhydrated and hydrated constituents by the application of Hess's law of constant heat summation, which states that the change in heat content of a system in passing from one state to another is independent of the path.

Kenneth Taylor and Lansing S. Wells, of the Bureau's lime and gypsum section, have found that the heat of solution of magnesium oxide (a constituent of some limes) in hydrochloric acid depends on the temperature of preparation.

It is believed that the decrease in the heat evolved may be ascribed mainly to an increase in the particle size of the MgO as the temperature of ignition was increased. Since X-ray diffraction patterns were similar there appeared to be

no change in crystalline form. The increase in particle size was indicated by a decrease in the rate of solution in the calorimeter and was verified by sedimentation experiments.

Likewise, the heat of solution of $Mg(OH)_2$ was also found to vary somewhat depending upon the method of preparation. Consequently, the heat of hydration of MgO to $Mg(OH)_2$ as derived from the heat-of-solution data may vary depending upon characteristic properties of both MgO and $Mg(OH)_2$, values from —10.04 to —8.84 kcal per mole having been obtained.

Heat of solution values for CaO and $Ca(OH)_2$ in hydrochloric acid of two concentrations were obtained, from which was calculated the heat of hydration of CaO to $Ca(OH)_2$. The heat of hydration was also measured by direct hydration of CaO in saturated lime water. The values were compared with those obtained by other investigators.

The complete report of this work will be published as RP1121 in the Journal of Research for August.

## HEAT OF HYDRATION OF PORTLAND CEMENT

When water is added to portland cement the processes of hydration and hardening of the resultant paste are accompanied by an evolution of heat. In an investigation by William Lerch, reported in the Journal of Research for August (RP1127), the heat of hydration was determined for a number of cements prepared from clinker which had been subjected to various heat treatments to produce different glass contents. The results indicate that, when different cements are ground to about the same degree of fineness, the quantity of heat evolved at early ages will be dependent on two factors: The oxide composition of the cement, and the glass content of the clinker. The glass content not only influences the heat of hydration directly, but also influences it indirectly, through its effect upon the true compound composition.

## SIZES OF CONCRETE BUILDING UNITS

Simplified Practice Recommendation R32–38, Concrete Building Units, is the second revision of this program, which lists stock sizes of concrete block, tile, and brick. It became effective August 1, 1938.

The initial steps in reducing the variety of sizes of these products were taken during 1923 by members of the industry, who decided to request the assistance of the Bureau in establishing a simplified schedule of sizes. Several preliminary conferences were held, in which representatives of the American Concrete Institute, the Portland Cement Association, the Concrete Masonry Association, and the machinery manufacturers participated. These meetings were followed by a general conference of all interests, which approved a recommendation effecting a substantial reduction in the existing variety of sizes. This recommendation became effective in 1925.

The simplified list of sizes as originally promulgated was reaffirmed without change by the standing committee in 1927 and in 1928, and it was revised for the first time in 1932, in line with certain changes in industry practice.

In February 1938, the standing committee met during the annual convention of the National Concrete Masonry Association, and considered the addition of four units, 11¾ inches in length, to the list of block and tile sizes. In view of the increasing importance of units of this length, the committee proposed that the recommendation be revised by this addition. No changes were suggested in connection with concrete brick. The proposed revision, upon being circulated, was favorably received by the industry and others concerned.

The revised printed issue will include a brief history of the development of the project, and will list the current personnel of the standing committee and the acceptors of the recommendation.

Until the printed recommendation is available, free mimeographed copies of the revision may be obtained from the Division of Simplified Practice, National Bureau of Standards, Washington, D. C.

## SIZES OF WOODEN BOXES

The promulgation in recent years of a considerable number of simplified practice recommendations for containers suggested to the wooden box industry the desirability of developing a similar program for their product. Accordingly, the manufacturers, acting through the National Wooden Box Association, requested the Bureau to cooperate in establishing a recommendation for sizes of wooden boxes.

Pursuant to the request of the industry, in March 1938, a proposed schedule, formulated by the abovementioned association, was submitted for consideration and approval to box manufacturers, canners, food distribu-

tors, carriers, and others concerned. A sufficient number of acceptances were received to warrant promulgation of this program as Simplified Practice Recommendation R171–38, Wooden Boxes for Canned Fruits and Vegetables, effective from July 1, 1938.

The recommendation, which comprises a list of inside dimensions for 27 sizes of wooden boxes used in the shipment of canned fruits and vegetables, is based on the schedule of 21 standard sizes of cans covered by Simplified Practice Recommendation R155–37. In addition to the box dimensions, the simplified schedule shows the number of cans to be packed in each box and their arrangement.

A standing committee, composed of members of the industry and allied groups, has been appointed to have charge of the recommendation with a view to keeping it abreast of current practice. The printed issue will list the personnel of this committee and the acceptors of the recommendation, and will include, also, a brief statement of the development of the project.

Until the printed recommendation is available, free mimeographed copies may be obtained from the Division of Simplified Practice, National Bureau of Standards, Washington, D. C.

## RESEARCH ON BUILDING MATERIALS AND STRUCTURES

The first paper in a new series of Bureau publications, entitled "Reports on Building Materials and Structures," was released last month. For many years the Bureau has developed test methods, made tests, and conducted research on, and helped to formulate specifications for building materials, such as cement, lime, brick, tile, and steel. The results of this work have been published in the Journal of Research and in trade periodicals, or are embodied in specifications of the Federal Government, and of cooperating technical societies and industries.

During the past year the problem of applying technical research in the building industry has been approached in a new way, which is explained in the present paper. In this paper, which tells of the objectives, procedure, and scope of the research on building materials and structures for use in low-cost housing now being carried on at the Bureau, acknowledgment is made to the Central Housing Committee, its various affiliated groups, and cooperating individuals, for their invaluable advice and assistance. The paper is obtainable from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 10 cents a copy.

The technical aspects, with test procedures, and results will be set forth in later reports in the series, which will be issued at irregular intervals as portions of the work are completed. Those desiring to obtain the reports automatically as issued can do so by forwarding a deposit to the Superintendent of Documents. Details of the purchasing procedure should be obtained from the Government Printing Office.

## NEW AND REVISED PUBLICATIONS ISSUED DURING JULY 1938

### Journal of Research [2]

Journal of Research of the National Bureau of Standards, volume 21, number 1, July 1938 (RP1110 to RP1119, inclusive). Price 30 cents. Annual subscription, 12 issues, $3.50.

### Research Papers [2]

[Reprints from April and May 1938 Journal of Research]

RP1086. Cross-connections in plumbing systems. Roy B. Hunter, Gene E. Golden, and Herbert N. Eaton. Price 15 cents.

RP1093. Heat of combustion of isoprene. Ralph S. Jessup. Price 5 cents.

RP1094. Electromotive force of saturated Weston standard cells containing deuterium oxide. Langhorne H. Brickwedde and George W. Vinal. Price 5 cents.

RP1096. Maximum usable frequencies for radio sky-wave transmission, 1933 to 1937. Theodore R. Gilliland, Samuel S. Kirby, Newbern Smith, and Stephen E. Reymer. Price 5 cents.

RP1100. Application of vertical-incidence ionosphere measurements to oblique-incidence radio transmission. Newbern Smith. Price 10 cents.

### Simplified Practice Recommendations [2]

R92–38. Hard fiber twine and lath yarn ply and yarn goods). Supersedes R92–33.) Price 5 cents.

R133–38. Surgical dressings. (Supersedes R133–33.) Price 5 cents.

### Circulars [2]

C421. Spectral-transmissive properties and use of colored eye-protective glasses. W. W. Coblentz and R. Stair. Price 10 cents.

(See footnote on p. 78)

Reports on Building Materials and Structures [2]

BMS1. Research on building materials and structures for use in low-cost housing. Hugh L. Dryden. Price 10 cents.

Technical News Bulletin [2]

Technical News Bulletin 255, July 1938. Price 5 cents. Annual subscription, 50 cents.

## MIMEOGRAPHED MATERIAL

Letter Circulars

Letter Circulars are prepared to answer specific inquiries addressed to the National Bureau of Standards, and are sent only on request to persons having definite need for the information. The Bureau cannot undertake to supply lists or complete sets of Letter Circulars or send copies automatically as issued.

LC522. Metallurgy: Publications by staff of the National Bureau of Standards. (Supersedes LC118.)

LC528. Testing laboratories equipped for thermal expansion tests of solids. (Supersedes LC234.)

## RECENT BUREAU ARTICLES APPEARING IN OUTSIDE PUBLICATIONS [3]

Comparisons of soundings with radio meteorographs, aerographs, and meteorographs. H. Diamond, W. S. Hinman, Jr., and E. G. Lapham. Bul. Am. Meteorological Soc. (Blue Hill Observatory, Milton, Mass.) **19,** 129 (April 1938).

Thermal expansion and effects of heat treatments on the growth, density, and structure of some heat-resisting alloys. Peter Hidnert. Physical Rev. (11 East 38th St., New York, N. Y.) **53,** 925 (June 1, 1938).

The presence of rare earths in hickory leaves. W. O. Robinson and Richard Whetstone (Bureau of Chemistry and Soils), and Bourdon F. Scribner. Science (Grand Central Terminal, New York, N. Y.) **87,** 470 (May 20, 1938).

Permanence of plastics. Gordon M. Kline. Modern Plastics (425 Fourth Ave., New York, N. Y.) **15,** 40 (June 1938).

Effect of carbon on hardenability of high-purity iron-carbon alloys. T. G. Digges. Trans. Am. Soc. Metals (7016 Euclid Ave., Cleveland, Ohio) **26,** 408 (June 1938).

[2] Send orders for publications under this heading only to the Superintendent of Documents, Government Printing Office, Washington, D. C. Subscription to Technical News Bulletin, 50 cents per year; Journal of Research, $3.50 per year (United States and its possessions, and Canada, Colombia, Cuba, Dominican Republic, Ecuador, Guatemala, Honduras, Mexico, Newfoundland (including Labrader), Panama, and Venezuela); other countries, 70 cents and $4.50, respectively.

[3] These publications are not obtainable from the Government. Requests should be sent direct to the publishers.

U. S. GOVERNMENT PRINTING OFFICE: 1938